TIER 1 GUIDANCE

Site Assessment of

Leaking Underground Storage Tanks (LUST)

Using Risk-Based Corrective Action (RBCA)

Iowa Department of Natural Resources
Underground Storage Tank Section
Wallace State Office Building
502 East Ninth Street
Des Moines, IA 50319-0034
515/281-8693

Version 1.0 -- November 1996

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IMPORTANT: This document, "Tier 1 Guidance (version 1.0 -- November 1996)", is a draft version. Incorporated into this draft guidance are proposed rule changes which were made in response to public comments. Because the rule changes have not received final approval, the content of this document may change. The department anticipates revision of this guidance within the next few months and updated versions will be made available at that time (see general instructions).

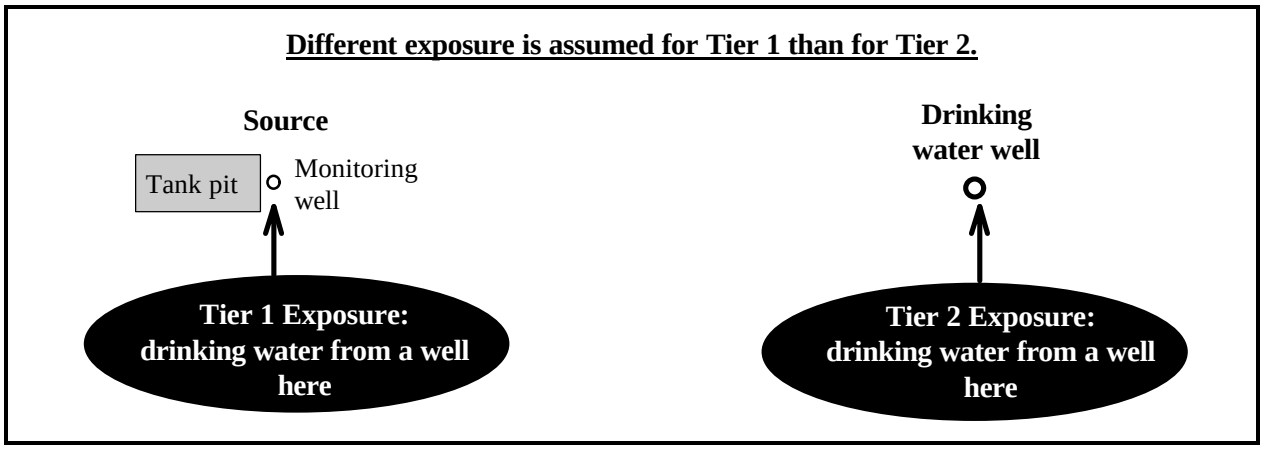
RISK-BASED CORRECTIVE ACTION OVERVIEW

General: The objective of risk-based corrective action is to evaluate the risks posed by contamination to human health, safety and the environment using a progressively more site-specific, three-tiered approach. Based on the tiered assessment, corrective action must remove or minimize risks to acceptable levels. There are several corrective action options including reducing contamination through active or passive methods, monitoring, using technological controls, and using institutional controls.

Tier 1: The purpose of a Tier 1 assessment is to use limited site data to determine whether sites pose an unreasonable risk to public health and safety or the environment. The general Tier 1 procedure is as follows: 1) conduct a field investigation to determine the maximum concentrations of chemicals of concern in soil and groundwater associated with the petroleum release; 2) survey the surrounding area for receptors to determine which pathways are complete; and 3) compare maximum contaminant concentrations with the Tier 1 levels in Tier 1 Look-up Table for those pathways which are complete to determine whether the applicable standards are exceeded for each complete pathway.

Tier 1 assumes worst-case scenarios in which actual or potential receptors could be exposed to chemicals of concern through certain soil and groundwater pathways. The point of exposure is assumed to be at the source showing maximum concentrations. The Tier 1 levels in the Tier 1 Look-up Table have been derived from models which use conservative assumptions to predict contaminant movement and exposure to receptors. These models and default assumptions are contained in Appendix A of Chapter 135. If the maximum concentrations do not exceed the Tier 1 levels for a pathway, further assessment of that pathway may not be required. If the maximum concentrations exceed a Tier 1 level, the options are to conduct a more extensive Tier 2 assessment, apply an institutional control or, in limited circumstances, excavate contaminated soil to below Tier 1 levels. If all pathways clear the Tier 1 levels, it is possible for the site to obtain a no action required classification.

Tier 2. The objective of a Tier 2 assessment is to collect additional site-specific data and, with the use of Tier 2 fate and transport modeling, determine what actual and potential receptors could be impacted by chemicals of concern. Generally the contaminant plume is defined to the Tier 1 levels for pathways which were not cleared at Tier 1. Tier 2 models are then used to predict the maximum future extent of contamination. Tier 2 models are also used to predict concentrations at the source (site-specific target levels) which would not present a risk to the receptors.



Tier 3. Where site conditions may not be adequately addressed by Tier 2 procedures, a Tier 3 assessment may provide more accurate risk assessment data. The purpose of Tier 3 is to identify reasonable exposure levels of chemicals of concern and to assess the risk of exposure to existing and potential receptors based on additional site assessment information, probabilistic evaluations, or more sophisticated chemical fate and transport models.

INSTRUCTIONS

IMPORTANT: This document provides instructions for conducting a Tier 1 site assessment and preparing a Tier 1 report. Use this guidance in conjunction with the Tier 1 software and/or the attached report form to complete the Tier 1 report. Read all instructions before completing the form.

GENERAL INFORMATION

Report Submittal: A Tier 1 report must be submitted to the department **within 90 calendar days from the date the petroleum release was confirmed.** If the owner or operator elects to prepare a Tier 2 Site Cleanup Report instead of a Tier 1 report, the department must be notified in writing prior to the expiration of the Tier 1 report submission deadline.

A blank copy of the Tier 1 report form is attached. The groundwater professional may use the hard copy version or the computer software version to complete the report. A 486 Intel 50 MHz processor with 8 MB RAM and 4 MB hard drive, and Windows 3.1 or Windows 95 is recommended to run the RBCA software. The RBCA software which includes programs for conducting both Tier 1 and Tier 2 evaluations can be obtained from the IDNR Records Center at a cost. The department's Tier 1 report form is also available as a Word for Windows document on disk which may be obtained from the IDNR Records Center by calling 515/242-5818. A hard copy of the Tier 1 report must be submitted to the department and if the Tier 1 software is used to complete the Tier 1 analysis, a 3.5-inch high density disk which contains the site file(s) created from the software must be submitted along with the hard copy printout. Please use the LUST (Leaking Underground Storage Tank) number for the name of the file.

The department anticipates revising the guidance documents and the RBCA software in the near future. All Iowa certified groundwater professionals will be sent updates of both the guidance documents and the software package as they become available. Other interested parties may obtain updated versions of the guidance documents and software by submitting a written request to the IDNR, LUST Coordinator at the address in the next paragraph. The written request must include the name and mailing address of the person making the request.

Send one copy of the completed Tier 1 report to the Iowa Department of Natural Resources, LUST Coordinator, Wallace Building, Des Moines, IA 50319-0034 and, if the state UST Fund is being used, send one copy to GAB Robins, PO Box 3837, 2600 72nd Street, Suite A, Des Moines, IA 50322.

Copies of administrative rules referenced in this document may be obtained from IDNR Records Center by calling 515/242-5818. This document references various Chapters of 567 IAC (Iowa Administrative Code)(455B).

Budget Approvals: UST owners and operators eligible to receive state funds to cover site investigation expenses must submit the Tier 1 preparation budget prior to initiating work at the site to GAB Robins, PO Box 3837, 2600 72nd Street, Suite A, Des Moines, IA 50322, 515/276-8046. Failure to receive budget approval from GAB Robins prior to starting work at the site may result in a loss of state benefit eligibility.

Report Preparation: The cover page of the Tier 1 report must be signed by the responsible party and a certified groundwater professional. It is the responsibility of the tank owner or operator to ensure the groundwater professional prepares a report appropriate for the conditions at the site. All groundwater and soil data obtained during the Tier 1 field assessment must be collected by or under the supervision of an Iowa certified groundwater professional.

To the extent practicable, during the preparation of the Tier 1 report, use generally available hydrologic, geologic, topographic, and geographic information in an attempt to minimize site-specific testing. In many instances, an area is provided in the Tier 1 report form to record a response. A response must be provided for all questions unless

directed otherwise in the instructions. However, please try to limit the response to the area provided. If an expanded response is required, reference it as an attachment.

The completed Tier 1 report form must be accompanied by the maps and appendices listed in the "Requirements for Report Maps and Appendices" section at the end of this guidance. The appendices consist of analytical data, boring logs, etc. Number and title each appendix as listed in bold print and attach in the same order as listed. Ensure all maps are legible, have a north arrow, scale and legend. If possible, maps should either be prepared on 8½ x 11 inch paper or reduced to that size by a single fold preferably with north at the top of the page. Additional reports containing pertinent data not required by the Tier 1 assessment may be submitted as attachments. This does not mean photocopy the LUST file and add it as an attachment. However, please ensure the Tier 1 report contains all the information requested.

A checklist of all the components of the Tier 1 report is included with the form to assist with report compilation. Those items which may not be necessary for all reports are labeled "optional". Information specific to the site will dictate whether some optional items must be included (identified below). It is the responsibility of the groundwater professional to determine what site-specific information must be included to produce a complete report.

The Tier 1 report consists of the results of a field assessment, pathway evaluations, and either a corrective action response or no action required site classification recommendation. A no action required site classification may be obtained if the concentrations of chemicals of concern do not exceed the Tier 1 levels for any pathway. If a Tier 1 level is exceeded for any pathway, a no action required site classification can be obtained if acceptable corrective actions are implemented. Corrective action response options permitted for pathways which fail the Tier 1 analysis are identified within this guidance. If the corrective actions cannot be implemented, a Tier 2 Site Cleanup Report (SCR) must be completed to evaluate those pathways not cleared at Tier 1.

If the Tier 1 levels are not exceeded for an individual pathway, the corresponding part of the receptor survey specific to that pathway need not be conducted. For example, if the maximum concentrations of chemicals of concern in groundwater and soil are below the applicable Tier 1 levels for the groundwater to plastic water line pathway and soil to plastic water line pathway, then a survey for plastic water lines within 200 feet of the source is not required. However, certain parts of the receptor survey must be conducted in accordance with instructions in the "Receptor Survey" section of this guidance regardless of the actual contaminant concentrations (e.g., explosive vapor survey, visual inspection of surface waters within 200 feet of the source).

A **no action required** site classification may be proposed upon completion of Tier 1 if all the criteria for pathway clearance have been met for every pathway. Note, however, all corrective actions necessary to satisfy the criteria for pathway clearance must be conducted prior to submittal of a Tier 1 report which requests such a site classification. The department must be informed if these corrective actions require more than 90 days to complete. All documentation which supports the corrective actions must be submitted as attachments to the Tier 1 report. Documentation may include any of the following:

- Completed well plugging forms
- Proof of institutional controls (copies of deed restrictions, declaration of restrictive covenants, etc.)
- Copies of local ordinances or regulations which prevent placement of wells or use of groundwater
- Copies of notices to the IDNR Water Supply Section
- Copies of notices to county authorities which issue private water supply construction permits
- Report of soil excavation activities
- Report of plastic water line replacement or relocation
- Copies of notices to utility companies which supply water to the area of concern

If, upon completion of the Tier 1 analysis, some pathways can be cleared by conducting the appropriate corrective action, but a Tier 2 assessment is required to evaluate other pathways, documentation of corrective action for the "conditionally" cleared pathways may be submitted with the Tier 2 SCR.

Conditions Requiring a Tier 2 Site Assessment:

1. **Free Product.** Notify the department within 24 hours if free phase product is encountered during on-site work. The LUST personnel assigned to each region of the state and their direct phone numbers are provided in Appendix A of this guidance document. Free product removal must be conducted in accordance with Subrule 135.7(5) and reported to the IDNR on the attached IDNR Forms 542-1424 and 542-1425. If free product is present, the Tier 1 guidance document is no longer applicable for site evaluation. A Tier 2 SCR must be completed in accordance with the requirements in the Tier 2 SCR guidance document.

2. **Shallow Bedrock.** Prior to conducting any groundwater drilling, a groundwater professional must determine if there is a potential to encounter bedrock before groundwater. These potential areas include (1) areas where karst features or outcrops exist within one mile of the site and (2) areas with bedrock less than 50 feet from the surface as illustrated in Appendix B of this guidance. The purpose of this determination is to prevent drilling through contaminated subsurface areas thereby creating a preferential pathway to a bedrock aquifer. If bedrock is encountered before groundwater, a Tier 2 SCR must be completed in accordance with the requirements in the Tier 2 SCR guidance document, and special bedrock procedures in Subrule 135.10(3). If the first encountered groundwater is above bedrock but near the bedrock surface, or fluctuates above and below bedrock, the groundwater professional should evaluate the sub-surface geology and aquifer characteristics to determine the potential for creating a preferential pathway. If it is determined the aquifer shows extraordinary variations or inconsistencies in groundwater flow, groundwater elevations across the site, hydraulic conductivities, or total dissolved solid concentrations among monitoring wells, a Tier 2 assessment using special bedrock procedures must be conducted. If the first encountered groundwater is above the bedrock with sufficient separation and aquifer characteristics to establish that it acts as a granular aquifer as provided in 135.10(3)"a", a Tier 1 assessment must be conducted as provided in this guidance.

3. **Explosive Vapor Levels.** If, during the course of the Tier 1 investigation, explosive vapor levels are identified (concentrations of combustible gases exceeding 10% of the Lower Explosive Limit [LEL]), the groundwater professional must notify the owner or operator with instructions to report the condition in accordance with 567--Chapter 131. The owner or operator must begin immediate response and abatement procedures in accordance with 135.7 and 567--Chapter 133. The condition will be handled under IDNR's Emergency Response protocols. A Tier 2 SCR must be completed in accordance with the requirements in the Tier 2 SCR guidance document for the vapor-specific pathways; however, a Tier 1 evaluation may be conducted to obtain clearance for those pathways not specific to vapor hazards.

Laboratory Methods: Laboratories which analyze soil and water samples from releases of petroleum-regulated substances must be certified (under 567--Chapter 42, Part C) in accordance with 135.16. A list of certified laboratories may be obtained from the IDNR by calling 515/242-6492.

Soil and groundwater samples from releases of petroleum-regulated substances must always be analyzed for the presence of benzene, ethylbenzene, toluene, and xylenes. Additionally, if the release is suspected to include any petroleum-regulated substance other than gasoline or gasoline blends, or if the source of the release is unknown, the soil and groundwater samples must be tested for the presence of Total Extractable Hydrocarbons (TEH).

Iowa Method OA-1 (*revision 7/27/93*) shall be used for the analysis of soil and water for high volatile petroleum compounds (i.e., benzene, ethylbenzene, toluene, xylene). Iowa Method OA-2 (*revision 7/27/93*) shall be used for

the analysis of soil and water for low- or semi-volatile petroleum compounds (i.e., all grades of diesel fuel, fuel oil, kerosene, oil, and mineral spirits). Copies of Iowa Methods OA-1 and OA-2 are available from IDNR by calling 515/242-6492.

A copy of the chromatograms and associated quantitation reports for the waste oil, diesel, and gasoline standards used by the laboratory to identify and quantify the field samples must be submitted. The laboratory analytical report must state whether the sample tested matches the laboratory standard for waste oil, diesel or gasoline or that the sample cannot be reliably matched with any of these standards.

Soil Gas Analysis: The National Institute for Occupational Safety and Health (NIOSH) Method 1501, or a department-approved equivalent method, shall be used for the analysis of soil gas for benzene and toluene vapors. NIOSH Method 1501 is published in the NIOSH Manual of Analytical Methods, 1994. If an alternative soil gas analytical method is to be used, a proposal must be submitted to the department prior to its use. The proposal must contain a justification for the use of an alternative method and a copy of the method including information on sample preparation, calibration, quality control, equipment and materials used in sample extraction and analysis, and calculations used to determine concentrations of chemicals of concern.

Quality Control/Quality Assurance Procedures: The quality control/quality assurance (QC/QA) procedures used during the site investigation must be at least as stringent as those contained in IDNR's Leaking Underground Storage Tank Quality Assurance Plan. Copies of IDNR's Leaking Underground Storage Tank Quality Assurance Plan may be obtained by calling 515/242–6492. The groundwater professional must be able to provide IDNR with copies of the QC/QA plan designed for the site, field notes and chain of custody forms on request.

Plugging Abandoned Wells And Borings: All abandoned wells and borings that access groundwater must be plugged according to 567--Chapter 39. Contact the IDNR Water Supply Section (515/281-7814) for additional information concerning this requirement. IDNR Form 542-1226 must be completed for all plugged wells and boreholes. Note, however, that monitoring wells used to assess the release under investigation should not be plugged until the department has approved a no action required classification for the site.

Review process: Upon receipt of the Tier 1 report, the department may either conduct a cursory review of the report for completeness relying on the groundwater professional for accuracy and compliance with the department's rules, or conduct a more thorough review to determine whether the report is complete, accurate, and in compliance with the department's rules. Incomplete Tier 1 reports and Tier 1 reports not submitted in the format required by this document and Subrule 135.9(11) will be rejected. If the department does not send a response within 60 days from the date the department receives the report, the report will be considered accepted for the purposes of completeness. If the groundwater professional proposes a no action required site classification, the 60-day limitation does not apply and the department will conduct a thorough review of the report for completeness, accuracy, and compliance with the department's rules to determine whether the data and information support the site classification.

Iowa Tier 1 Look-Up Table								
Media	Exposure Pathway	Receptor	Group 1				Group 2: TEH	
			Benzene	Toluene	Ethylbenzene	Xylenes	Diesel*	Waste Oil
Groundwater (µg/L)	Groundwater Ingestion	actual	5	1,000	700	10,000	1,200	400
		potential	290	7,300	3,700	73,000	75,000	40,000
	Groundwater Vapor to Enclosed Space	all	1,540	20,190	46,000	NA	2,200,000	NA
	Groundwater to Plastic Water Line	all	290	7,300	3,700	73,000	75,000	40,000
	Surface Water	all	290	1,000	3,700	73,000	75,000	40,000
Soil (mg/kg)	Soil Leaching to Groundwater	all	0.54	42	15	NA	3,800	NA
	Soil Vapor to Enclosed Space	all	1.16	48	79	NA	47,500	NA
	Soil to Plastic Water Line	all	1.8	120	43	NA	10,500	NA

TEH: Total Extractable Hydrocarbons. The TEH value is based on risks from naphthalene, benzo(a)pyrene, benz(a)anthracene, and chrysene. Refer to Appendix B for further details.
Diesel*: Standards in the Diesel column apply to all low volatile petroleum hydrocarbons except waste oil.

NA: Not applicable. There are no limits for the chemical for the pathway, because for groundwater pathways the concentration for the designated risk would be greater than the solubility of the pure chemical in water, and for soil pathways the concentration for the designated risk would be greater than the soil concentration if pure chemical were present in the soil.

ug/L = ppb ; mg/kg = ppm

Soil Gas Target Levels				
Exposure Pathway	Unit Equivalents		Chemicals of Concern	
			Benzene	Toluene
Soil Vapor to Enclosed Space	Soil Gas	(µg/m^3)	600,000	9,250,000
		(ppm)	190	2,500

TIER 1 PATHWAY EVALUATION

General Tier 1 Procedure.

The objective of the Tier 1 field investigation is to identify maximum concentrations of chemicals of concern associated with a release(s) originating on site. Additionally, the placement and depth of borings and monitoring wells must be sufficient to determine the vertical extent of soil contamination, an adequate description of site stratigraphy, and a reliable determination of groundwater flow direction. At Tier 1, the point of exposure for receptors and the point of compliance is the location of the presumed source of a release. The presumed sources of the release are the locations of soil and groundwater showing the maximum concentrations of chemicals of concern. The Tier 1 assessment requires a determination of whether a pathway is complete, an evaluation of actual or potential receptors, a determination of whether conditions are satisfied for obtaining no further action clearance for individual pathways or for obtaining a complete site classification of no action required, and a corrective action response.

Pathway assessment. The pathways to be evaluated at Tier 1 are the groundwater ingestion pathway, soil leaching to groundwater pathway, groundwater vapor to enclosed space pathway, soil vapor to enclosed space pathway, groundwater to plastic water line pathway, soil to plastic water line pathway and the surface water pathway. A pathway is considered complete if a chemical of concern has a route by which it may reach an actual or potential receptor.

Receptor evaluation. Receptors are of two categories - actual and potential. Actual receptors include drinking and non-drinking water wells, public water systems, enclosed spaces, conduits, and surface water bodies which, when impacted by chemicals of concern, may result in exposure to humans and aquatic life, explosive conditions or other adverse effects. Potential receptors are also considered in the receptor evaluation. Potential receptors are receptors not in existence at the time a Tier 1, Tier 2, or Tier 3 assessment is conducted, but could reasonably be expected to exist within 20 years. A protected groundwater source is also a potential receptor because its possible future use as drinking water. The receptors of concern for each pathway which must be evaluated are identified in the pathway-specific sections of this guidance.

Source. At Tier 1, “source” refers to the maximum concentrations of chemicals of concern, regardless of the origin of the petroleum release.

Pathway Clearance. If the maximum concentrations of chemicals of concern do not exceed the applicable Tier 1 levels in the Tier 1 Look-up Table for a pathway, or if a pathway is incomplete, further assessment of that pathway is not required. (The pathway obtains “clearance”). If the maximum concentrations for all chemicals of concern within a designated group of chemicals are below the Tier 1 levels, no further action is required regarding that group of chemicals (see Tier 1 Table for list of Group 1 and Group 2 chemicals). However, if in the course of conducting further site assessment, data indicate the Tier 1 levels for a cleared pathway are exceeded, the pathway must be reevaluated as part of the Tier 2 or Tier 3 assessment. Pathways which do not obtain a no further action clearance must then be evaluated under an applicable Tier 2 or Tier 3 assessment procedure. A no action required site classification only applies when all pathways obtain no further action clearance.

Corrective Action Response. If the maximum concentrations exceed a Tier 1 level, there are four basic corrective action response options: 1) conduct a Tier 2 assessment, 2) apply institutional controls, 3) sever a pathway by plugging wells or removing plastic water lines, or 4) in limited circumstances excavate contaminated soil to below the Tier 1 levels. Additionally, the owner or operator may be required to provide notifications of site conditions to authorities such as the IDNR Water Supply Section, utility companies which supply water services, and county authorities responsible for issuing private water supply construction permits. Corrective action responses permissible for each pathway are identified in the pathway-specific sections of this guidance. Technological controls are not acceptable at Tier 1.

Tier 1 Pathway-Specific Guidance.

The procedures for evaluating the seven pathways of concern are described below. The flow charts in Appendix C may also be used as guides to evaluate pathways, but should not be used exclusive of the rest of this guidance.

1. Groundwater Ingestion Pathway.

The groundwater ingestion pathway addresses the potential for human ingestion of petroleum-regulated substances from existing drinking water wells, existing non-drinking water wells, or potential drinking water wells that could access a usable contaminated groundwater source. The term "protected groundwater source" is intended to identify sources of groundwater that are considered usable as drinking water. (Refer to pages 23-24 for more information on protected groundwater source.)

Pathway completeness. This pathway is considered complete if 1) there is a drinking or non-drinking water well within 1,000 feet of the source, or 2) the first encountered groundwater meets the definition of a protected groundwater source.

Receptor Evaluation. A drinking water well which exists within 1,000 feet of the source area is considered an actual groundwater ingestion receptor and the Tier 1 levels for actual receptors are applied to drinking water wells. A non-drinking water well which exists within 1,000 feet of the source area is considered a potential groundwater ingestion receptor and the Tier 1 levels for potential receptors are applied to non-drinking water wells. Potential receptor points of exposure exist for the entire area if the first encountered groundwater is a protected groundwater source, and the Tier 1 levels for potential receptors apply to protected groundwater sources. Any combination of these receptors may exist, and each must be addressed using the applicable Tier 1 level and appropriate corrective action response.

Pathway Clearance.

- If the pathway is incomplete, no further action is required for this pathway.

- If the maximum concentrations of chemicals of concern do not exceed the applicable Tier 1 levels for actual or potential receptors, no further action is required for this pathway.

- If groundwater is not encountered during the investigation and the requirements for depth of drilling have been met and vulnerable bedrock is not encountered, this pathway cannot be evaluated and no further action is required for this pathway.

Corrective Action Response. If the pathway is complete and the maximum concentrations on site exceed the applicable Tier 1 levels for either actual or potential receptors the options are 1) conduct a Tier 2 assessment; or 2) implement effective institutional controls.

- Water well plugging is an acceptable form of institutional control. If the pathway is complete regarding drinking water wells and the maximum concentrations exceed the Tier 1 levels for actual receptors, all drinking water wells within 1,000 feet must be properly plugged. If the pathway is complete regarding non-drinking water wells and the maximum concentrations exceed the Tier 1 levels for potential receptors, all non-drinking water wells within 1,000 feet must be properly plugged.

- If a protected groundwater source exists and the maximum concentrations exceed the Tier 1 levels for potential receptors, the institutional control must prohibit the use of the protected groundwater source within 1,000 feet of the contamination source area. The owner or operator must also provide notification of the site conditions on a department form to the IDNR Water Supply Section and to the designated county authority responsible for

issuing private water supply construction permits as provided in 567--Chapters 38 and 49. If an institutional control is not obtained, a Tier 2 assessment must be conducted for this pathway.

- If the receptor type is potential due only to an existing protected groundwater source, and the maximum concentrations are below the Tier 1 levels for potential receptors, but exceed the Tier 1 levels for actual receptors, the owner or operator must provide notification of the site conditions on a department form to the IDNR Water Supply Section and to the designated county authority responsible for issuing private water supply construction permits as provided in 567--Chapters 38 and 49.

2. Soil Leaching to Groundwater Pathway.

This pathway addresses the potential for soil contamination to leach to groundwater. At Tier 1, this pathway evaluates risk of human exposure only through the groundwater ingestion pathway.

Pathway Completeness. If the groundwater ingestion pathway is complete, the soil leaching to groundwater pathway is considered complete. If groundwater is not encountered during the course of the investigation, the requirements for depth to drilling have been met, and bedrock has not been encountered, a survey for actual drinking and non-drinking water wells must be conducted. If actual wells exist within 1,000 feet of the source, this pathway is complete.

Receptor Evaluation. Drinking water wells, non-drinking water wells and protected groundwater sources are receptors for this pathway; however, only one Tier 1 level for each chemical of concern is applied to all receptor types.

Pathway Clearance.

- If the pathway is incomplete, no further action is required for this pathway.

- If the maximum concentrations of chemicals of concern in soil do not exceed the Tier 1 levels, no further action is required for this pathway.

Corrective Action Response. If the Tier 1 levels are exceeded for this pathway, the options are: 1) conduct a Tier 2 assessment; 2) establish institutional controls which satisfy the conditions applicable to the groundwater ingestion pathway as described previously; or 3) excavate contaminated soil for the purpose of removing all soil which exceeds the Tier 1 levels in accordance with Subrule 135.9(7)"h" and the "Corrective Action Response" section of this guidance document.

3. Groundwater Vapor to Enclosed Space Pathway.

This pathway addresses the potential for vapors from contaminated groundwater to migrate to enclosed spaces where humans could inhale chemicals of concern at unacceptable levels. This pathway evaluation assumes the health-based Tier 1 levels will also adequately protect for any short-term or long-term explosive risks.

Pathway Completeness. If groundwater is encountered, this pathway is always considered complete for purposes of Tier 1 and must be evaluated. This pathway is incomplete if groundwater is not encountered during the course of the investigation, the requirements for depth of drilling have been met, and bedrock is not encountered before groundwater.

Receptor evaluation. For the purpose of Tier 1, subsurface enclosed spaces are receptors and specifically include buildings with basements, storm and sanitary sewers, and underground utility vaults. Both existing subsurface enclosed spaces and potential subsurface enclosed spaces are considered and the same Tier 1 level for each chemical of concern is applied regardless of receptor type. Additionally, an explosive vapor survey of existing enclosed spaces must be conducted in accordance with procedures in "Receptor Survey" section of this guidance document.

Pathway Clearance.

- If the maximum concentrations of chemicals of concern do not exceed the Tier 1 levels *and* there are no explosive levels of vapors in enclosed spaces, no further action is required for this pathway.

Soil gas measurements (taken for the soil vapor to enclosed space pathway evaluation) may NOT be used to obtain clearance for the groundwater vapor to enclosed space pathway.

Corrective Action Response. If the maximum concentrations exceed the Tier 1 levels for this pathway the options are 1) conduct a Tier 2 assessment; or 2) implement an institutional control. The institutional control must effectively eliminate and prohibit the placement of subsurface enclosed spaces within 500 feet of the source.

- If potentially explosive levels (≥ 10% LEL) are detected when conducting the explosive vapor survey, the situation will be handled under IDNR's Emergency Response protocols. The groundwater professional must notify the tank owner or operator or a party reasonably believed to be responsible for reporting the contamination with instructions to report the condition in accordance with 567--Chapter 131. The tank owner or operator must begin immediate response and abatement procedures in accordance with 135.7 and 567--Chapter 133, as well as conduct a Tier 2 assessment.

- If soil gas measurements (taken for the soil vapor to enclosed space pathway evaluation) exceed the soil gas target levels and a Tier 2 assessment is the corrective action selected, **both the soil vapor to enclosed space pathway and the groundwater vapor to enclosed space pathway must be evaluated at Tier 2.**

4. Soil Vapor to Enclosed Space Pathway.

This pathway addresses the potential for vapors from contaminated soils to migrate to enclosed spaces where humans could inhale chemicals of concern at unacceptable levels. This pathway evaluation assumes the health-based Tier 1 levels will also adequately protect for any short-term or long-term explosive risks.

Pathway Completeness. This pathway is always considered complete for purposes of Tier 1 and must be evaluated.

Receptor evaluation. For the purpose of Tier 1, subsurface enclosed spaces are receptors and specifically include buildings with basements, storm and sanitary sewers, and underground utility vaults. Both existing subsurface enclosed spaces and potential subsurface enclosed spaces are considered and the same Tier 1 level for each chemical of concern is applied regardless of receptor type. If a soil Tier 1 level is exceeded, soil gas samples may be collected in accordance with procedures in the "Sampling Requirements" section of this guidance document. Soil gas measurements are evaluated against the soil vapor target levels for pathway clearance. Additionally, an explosive vapor survey of existing enclosed spaces must be conducted in accordance with procedures in the "Receptor Survey" section of this guidance document.

Pathway Clearance.

- If the maximum concentrations of chemicals of concern in soil do not exceed the Tier 1 levels, *and* if soil gas measurements and confirmation samples were taken and do not exceed the soil gas target levels or no soil gas measurements were taken, *and* no explosive levels of vapors have been identified, no further action is required for this pathway.

- If the maximum concentrations in soil exceed the Tier 1 levels, but soil gas measurements and confirmation samples taken at the location of maximum soil concentrations do not exceed the soil gas target levels, *and* no explosive levels of vapors have been identified, no further action is required for this pathway.

Corrective Action Response. The corrective action response options for this pathway are 1) conduct a Tier 2 assessment; 2) establish institutional controls which effectively eliminate and prohibit the placement of subsurface enclosed spaces within 500 feet of the source; or 3) excavate contaminated soil for the purpose of removing all soil which exceeds the Tier 1 levels in accordance with Subrule 135.9(7)"h" and the "Corrective Action Response" section of this guidance document.

- If the maximum soil concentrations exceed the Tier 1 levels for this pathway and the soil gas measurements exceed the soil gas target levels, or if no soil gas measurements were taken, corrective action is required.

- If the maximum soil concentrations do not exceed the Tier 1 levels, but soil gas measurements were taken and exceed the soil gas target levels, corrective action is required.

- If potentially explosive levels (≥ 10% LEL) are detected when conducting the explosive vapor survey, the situation will be handled under IDNR's Emergency Response protocols. The groundwater professional must notify the tank owner or operator or a party reasonably believed to be responsible for reporting the contamination with instructions to report the condition in accordance with 567--Chapter 131. The tank owner or operator must begin immediate response and abatement procedures in accordance with 135.7 and 567--Chapter 133, as well as conduct a Tier 2 assessment.

- If soil gas measurements exceed the soil gas target levels and a Tier 2 assessment is the corrective action selected, **both the soil vapor to enclosed space pathway and the groundwater vapor to enclosed space pathway must be evaluated at Tier 2.**

- If soil gas measurements exceed the soil gas target levels and excavation is the corrective action selected, soil gas measurements must again be taken after the excavation has been completed. The post-excavation soil gas measurements must be taken outside the excavated area, but near the area expected to exhibit the highest soil gas concentrations. For example, if the maximum benzene concentration remaining in soil after an excavation is 0.4 mg/kg from a sidewall sample, soil gas measurements should be collected near that sidewall. If the post-excavation soil gas measurements exceed the soil gas target levels, **both the soil vapor to enclosed space pathway and the groundwater vapor to enclosed space pathway must be evaluated at Tier 2.**

5. Groundwater to Plastic Water Line Pathway.

This pathway addresses the potential for creating a drinking water ingestion risk due to chemicals of concern in groundwater contacting plastic water lines and diffusing into the drinking water.

Pathway Completeness. This pathway is considered complete for actual receptors if there is an existing plastic water line within 200 feet of the source and the first encountered groundwater is less than 20 feet below the ground surface. The pathway is considered complete for potential receptors if the first encountered groundwater is less than 20 feet

below the ground surface. All current and any available historical groundwater elevation information must be considered and the estimated seasonal high level must be used for determining pathway completeness.

Receptor Evaluation. For the purposes of Tier 1, existing plastic water lines and potential plastic water lines are receptors; however, only one Tier 1 level for each chemical of concern is applied regardless of receptor type.

Pathway Clearance.

- If the pathway is not complete, no further action is required for this pathway. If the pathway is complete and the maximum concentrations of all chemicals of concern do not exceed the Tier 1 levels, no further action is required for this pathway.

- If the Tier 1 levels are exceeded, but no plastic water lines currently exist within 200 feet of the source, any utility company which could supply water service to the area must be notified of conditions at the site including the potential impact to plastic water lines should they later be installed. The form used to notify the utility company can be found as an attachment to this guidance document. After documentation is provided to the UST Section that the utility company has been notified, no further action will be required for this pathway regarding potential receptors.

Corrective Action Response. If the maximum concentrations exceed the Tier 1 levels for this pathway the options are 1) conduct a Tier 2 assessment; 2) replace all existing plastic water lines within 200 feet of the source with non-plastic lines; or 3) relocate the plastic lines beyond the 200-foot distance. Any utility company which could supply water service to the area must be notified of all existing plastic water lines which currently are in contact with contaminated groundwater or could potentially come in contact with contaminated groundwater. Notification of plastic water line impacts may be postponed until completion of a Tier 2 assessment, if a Tier 2 SCR is required.

6. Soil to Plastic Water Line Pathway.

This pathway addresses the potential for creating a drinking water ingestion risk due to chemicals of concern in soil permeating plastic water lines and diffusing into the drinking water.

Pathway Completeness. This pathway is considered complete for actual receptors if a plastic water line exists within 200 feet of the source. This pathway is always considered complete for potential receptors.

Receptor Evaluation. For the purposes of Tier 1, existing plastic water lines and potential plastic water lines are receptors; however, only one Tier 1 level for each chemical of concern is applied regardless of receptor type.

Pathway Clearance.

- If the pathway is complete for either actual or potential receptors and the maximum concentrations in soil do not exceed the Tier 1 levels for this pathway, no further action is required for this pathway.

- If the pathway is not complete for actual receptors, no further action is required for this pathway. However, if the pathway is not complete for actual receptors, but the Tier 1 levels are exceeded, any utility company which could supply water service to the area must be notified of conditions at the site including the potential impact to plastic water lines should they be installed later. The form used to notify the utility company can be found as an attachment to this guidance document. After documentation is provided to the UST Section that the utility company has been notified, no further action will be required for this pathway regarding potential receptors.

Corrective Action Response. If the maximum concentrations exceed the Tier 1 levels for this pathway the options are 1) conduct a Tier 2 assessment; 2) replace all existing plastic water lines within 200 feet of the source with non-plastic lines; 3) relocate the plastic lines beyond the 200 foot distance; or 4) excavate contaminated soil for the purpose of removing all soil which exceeds the Tier 1 levels in accordance with Subrule 135.9(7)"h" and the "Corrective Action Response" section of this guidance document. Any utility company which could supply water service to the area must be notified of all existing plastic water lines which currently are in contact with contaminated soil or could potentially be in contact with contaminated soil. Notification of plastic water line impacts may be postponed until completion of a Tier 2 assessment, if a Tier 2 SCR is required.

7. Surface Water Pathway.

This pathway addresses the potential for contaminated groundwater to impact surface water bodies creating risks to human health and aquatic life.

Pathway Completeness. This pathway is considered complete if a surface water body is present within 200 feet of the source. For purposes of Tier 1, surface water bodies include both general use segments and designated use segments as provided in Subrule 61.3(1). Appendix G contains excerpts from Chapter 61 which are relevant for the evaluation of LUST sites.

Receptor Evaluation. The Tier 1 levels for this pathway only apply to designated use segments of surface water bodies as defined in Subrule 61.3(1) and 61.3(5). The point of compliance is the source area with the maximum concentrations of chemicals of concern. General use segments of surface water bodies as provided in Subrule 61.3(1)"a" are only subject to the visual inspection criteria as required in Subrule 135.9(10)"c" and the "Receptor Survey" section of this guidance document. Designated use segments must also be visually inspected.

Pathway Clearance.

- If the pathway is not complete, no further action is required for this pathway.
- If the pathway is complete and the maximum concentrations do not exceed the Tier 1 levels, *and* there is no sheen or residue attributable to this site, no further action is required for assessment of this pathway.
- If a sheen or residue is present, in order to obtain pathway clearance, the groundwater professional must adequately justify that the origin of the sheen or residue is not the subject site.
- If a sheen or residue is present but not considered to be a petroleum-regulated substance, a sample must be laboratory analyzed to confirm it is not a petroleum-regulated substance in order to obtain pathway clearance.

Corrective Action Response.

- If the maximum concentrations of chemicals of concern exceed the Tier 1 levels for designated use segments or there is a petroleum sheen or residue attributable to the site, a Tier 2 SCR must be completed.
- If a sheen or residue is present, the department must be immediately notified.

SUMMARY PAGES

Cover Page: Fully complete the cover page of the Tier 1 report including signatures of the responsible party and certified groundwater professional. The street address is sufficient for site identification purposes. If a rural route, box number or street without a house number is used, then a legal description must be provided using the township, range, and ¼, ¼, ¼, ¼ section. If a no further action certificate is requested, an accurate legal description of the site, as found in the deed or mortgage, must be provided. The legal description may be submitted as an attachment if the space provided on the cover page is insufficient.

Site Data Summary: Complete the Site Data Summary on page 2 of the Tier 1 report form or corresponding summary in the software. If "yes" is the response to either of the first two questions, completion of the Tier 1 report form is not required. Notify the department in writing of the site conditions which prompted a Tier 2 assessment (e.g., presence of free product, bedrock encountered before groundwater, or explosive vapors) and indicate an intent to complete a Tier 2 SCR within 180 days of notification.

Sites which have been previously investigated may either use existing TPH and TEH data applying conversion default parameters (found in Appendix F of this guidance) or collect additional site-specific data for the Tier 1 analysis. Indicate whether TPH and / or TEH soil data collected prior to August 15, 1996 were converted using the default parameters to obtain BTEX concentrations. The larger BTEX default concentration must be used if both TPH and TEH are available. If soil BTEX data has been obtained, it must be used for the Tier 1 analysis. **Note, however, after November 15, 1996, soil and groundwater samples must always be analyzed for BTEX, and must be analyzed for TEH if the release is suspected to include any petroleum-regulated substance other than gasoline or gasoline blends, or if the source of the release is unknown.**

If portions of the receptor survey are not conducted because the applicable Tier 1 levels are not exceeded, then "Unknown" should be the selected response to the appropriate receptor question in the Site Data Summary or in the software.

Pathway Evaluation Summary

Complete the Pathway Evaluation Summary on page 3 of the Tier 1 report form (or the corresponding summary in the software) for all seven pathways. A response ("Passed" or "Failed") must be provided for both chemical groups for every pathway. If analysis for TEH or Group 2 chemicals was not conducted because only gasoline or gasoline blends have ever been stored, used, or sold on site, then "NA" for "not applicable" may be selected for Chemical Group 2.

Either corrective action or a Tier 2 assessment must be completed for failed pathways. Acceptable corrective actions for each failed pathway are identified on the pathway evaluation summary page and detailed further in the "Tier 1 Pathway-Specific Guidance" and "Tier 1 Corrective Action Response" sections. If an acceptable corrective action cannot be implemented, a Tier 2 assessment must be conducted. For each failed pathway, select either the corrective actions which have been completed and indicate the date completed, or "Go to Tier 2".

For the "Corrective Action Summary" provide a narrative description of all actions and activities which have been conducted to address the failed pathways. If there is additional documentation (e.g., well plugging forms, excavation maps and sampling results, etc.) indicate in the space provided that these have been attached as additional appendices. If, upon completion of the Tier 1 analysis, some pathways can be cleared by conducting the appropriate corrective action, but a Tier 2 assessment is required to evaluate other pathways, corrective action for these pathways may be postponed and supporting documentation may be submitted with the Tier 2 SCR. Indicate in the space provided those pathways with proposed corrective actions and that corrective action will be postponed until Tier 2, and leave "Date Completed" space blank for those corrective actions in the "Corrective Action Selected" column.

SITE HISTORY

Site Activity and Owner Chronology: A chronological summary of past and present site history, and underground storage tank ownership and operational history must be provided. The chronology must include all periods of time petroleum products have been stored, used or sold on site, and indicate whether aboveground or underground storage tanks were used. The following must be included in the site chronology: 1) current mailing addresses (complete with zip codes) of all previous owners and tank operators; 2) list of written contracts or agreements between land owners, tank owners and tank operators, 3) the number, capacity, and contents of past and present tanks, 4) site activities including the dates tanks were installed and/or removed, any previous subsurface or above ground releases, estimated quantity of release(s), nature of release(s), and past remediation or other corrective action.

Current Site Conditions: A description of the existing underground storage tank system which includes information on tank capacity, products stored, tank construction material and operational status must be provided. Sites with active tank systems must also provide copies of the most recent tank and piping tightness test results, a summary of leak detection results for the most recent quarter, and confirmation that the leak detection methods and results have been reviewed and no releases are indicated. Copies of leak detection results for the most recent quarter may also be submitted as supporting documentation of the integrity of the tank system. It may be necessary to explain testing anomalies and discuss any repairs which have been made to the system. Current proof of financial responsibility is required in accordance with 567--136.19 and 20. The status of coverage for corrective action under any applicable financial assurance mechanism or other financial assistance must be identified. For example, please state whether the petroleum release being investigated is covered by the Iowa Comprehensive Petroleum Underground Storage Tank Fund (i.e., State UST Fund).

SAMPLING REQUIREMENTS

General: The main objective of Tier 1 field assessment is to identify **maximum concentrations** of chemicals of concern in soil and groundwater. Additionally, the placement and depth of borings must be sufficient to determine: 1) the source(s) of contamination, 2) the vertical extent of soil contamination, 3) a description of site stratigraphy, and 4) the groundwater flow direction.

Where to Sample

Field screening is used to determine monitoring well placement as described below. At a minimum, soil samples must be collected for laboratory analysis from all borings which are converted to monitoring wells.

Monitoring Well Placement: A minimum of three permanent groundwater monitoring wells, subject to the limitations on maximum drilling depths as defined below, must be installed to measure groundwater contamination. At least one well must be placed at each suspected source of release. At a minimum, well locations shall include the pump island with the greatest field screening level, each current and former underground storage tank basin, and at other suspected sources of releases if field screening shows greater levels than at the pump islands or tank basins. A well must be installed in a presumed downgradient direction and within 30 feet of the source with the greatest field screening level. Three of the wells must be placed in a triangular arrangement to determine groundwater flow direction.

Where the circumstances which prompt a Tier 1 assessment identify a discreet source and cause of a release, and the groundwater professional is able to rule out other suspected sources or contributing sources such as pump islands, piping runs and tank basins, the application of field screening and groundwater well placement may be limited to the known source. However, a minimum of three groundwater monitoring wells is still required.

Soil Sample Collection: Soil samples must be collected for laboratory analysis from points indicated by high soil vapor readings, and/or observed contamination. Depending on field screening results, it may be necessary to collect soil from both the saturated and unsaturated zones in order to obtain representative samples. If no vapors are detected, soil must be collected from just above the estimated water table, or where discoloration or odor indicates potential petroleum contamination.

LOCATION OF SAMPLES

Location	Minimum Required Screening[1] (this is screening ONLY, NOT required soil samples)	Minimum Required Monitoring Wells and Soil Samples
Overall		3 placed in a triangular arrangement to measure groundwater flow direction
Each Tank Basin (former & current)	Minimum of one soil boring on each side of each tank basin, or if tanks no longer exist, below each tank into native soil	1 per tank basin
Pump Islands (former & current)	Minimum of one soil boring per pump island	1 at the pump island with the greatest concentrations
Piping	Minimum of one soil boring per 20 feet of piping. However, if documentation shows pipe joints are farther apart, then the minimum is one soil boring for each piping joint.	1 for piping if screening indicates greater concentrations than tank basin or pump island
Other Source Areas	Any other areas of actual or suspected releases	1 for other areas if screening indicates greater concentrations than tank basin or pump island
Presumed Downgradient[2]		1 downgradient and within 30 feet of the source with the maximum screening

[1] Fill pipe locations, closure reports, previously submitted assessment reports for this site or adjacent LUST sites, groundwater flow direction, etc., should be used as guides to indicate where screening should be performed.
[2] Local surface topography, previously submitted assessment reports for this site or adjacent LUST sites, etc., should be used as guides to indicate groundwater flow direction.

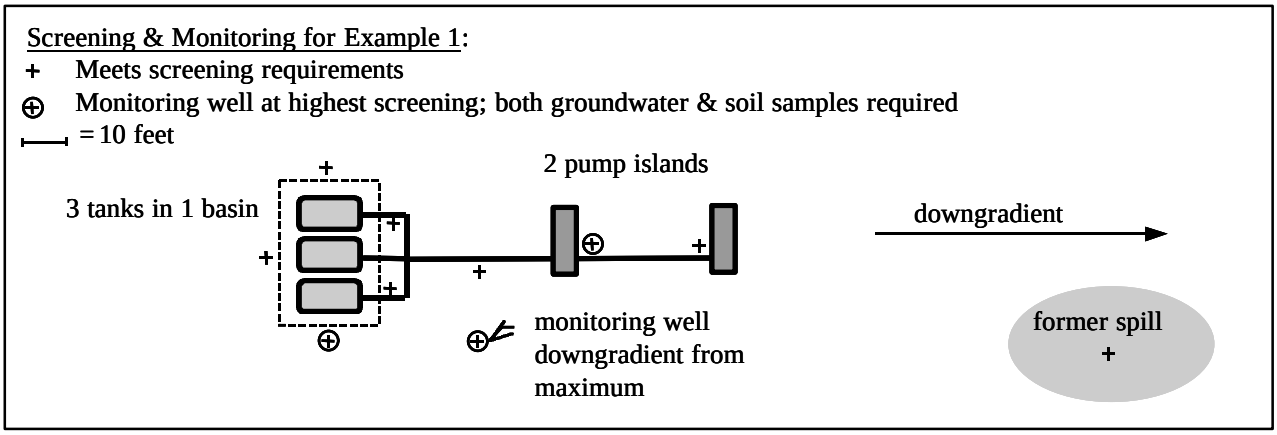
Possible Sampling Scenarios:

Example 1 (Minimum)	# Monitoring Wells
3 tanks in one basin	1
2 pump islands	1
piping screening < tank/island screening	0
spill screening in other area < tank/island screening	0
downgradient	1
TOTAL	**3***

Example 2 (Average Large Site)	# Monitoring Wells
6 tanks in 2 tank basins	2
6 pump islands	1
piping screening in several places > tank/island	1
spill screening in other area < tank/island	0
downgradient	1
TOTAL	**5**

Example 3 (Extremely Large & Contaminated Site)	# Monitoring Wells
10 tanks in 3 tank basins	3
20 pump islands	1
piping screening in several places > tank/island	1
spill screening in other areas > tank/island	1
downgradient	1
TOTAL	**7**

* The total number of samples will be twice the number of wells - e.g. three groundwater and three soil.



Other Soil and Groundwater Sampling Requirements

Monitoring Well Construction Permits: The Iowa Department of Natural Resources does not require construction permits for the installation of monitoring wells required for the completion of a Tier 1 assessment. However, you should check with the local health agency and county sanitarian for ordinances which may supersede those of IDNR.

Boring Depth for Sampling: While drilling groundwater monitoring wells, if groundwater is encountered, drilling must continue to the maximum of ten feet below the first encountered groundwater or to the bottom of soil contamination as estimated by field screening (described below). If groundwater is not encountered, drilling must continue to the deeper of ten feet below the soil contamination as estimated by field screening (soil vapors less than 10 ppm) or 75 feet from the ground surface.

Boring Depth for Screening: Soil borings used only for screening to locate a source need not be drilled to groundwater, but at a minimum, must be drilled to a depth of five feet below the base of existing tanks, dispensers, and piping; or five feet below the estimated base of former tanks, dispensers and piping. Additionally, **drilling must continue until field screening indicates decreasing levels of contamination.**

Exploratory Methods: Split spoon and continuous core are acceptable soil sampling devices. These may be used in conjunction with hollow-stem auger barrels. Direct-push technology with the use of equipment such as geoprobes® and hydropunches® in conjunction with portable gas chromatographs, as well as hand augers, and soil gas surveys are acceptable ***as screening tools*** to locate sources of contamination, maximum contaminant concentrations, and to determine the best placement for monitoring wells. If direct-push technology is utilized to locate the maximum contaminant concentrations, an expanded screening of the site is recommended, for example, sampling at more frequent intervals in a grid-type pattern.

Field Screening: Field screening must be used to determine the vertical extent of soil contamination and assist in selection of samples for laboratory analysis. Soil core samples must be screened continuously using appropriate vapor screening instruments, as well as other field techniques including visual and olfactory observations. Soil core samples must be screened the entire length of the boring and drilling must continue until the contamination is no longer detected (vapor readings are below 10 ppm). Acceptable field vapor screening instruments include photoionization detectors (PID), flame ionization detectors (FID), or other similar vapor analyzers. Equipment must be evaluated against a standard at the beginning and end of each day at the site and, if necessary, calibrated according to the manufacturer's specifications. Observations and vapor screening results must be documented on the boring logs.

Classification Of Soils: Use the Unified Soil Classification System (U.S. Department of Interior, Bureau of Reclamation) to describe soils and subsurface materials in boring logs, site narratives, etc.

Monitoring Well Design Suggestions: The diagram on the following page illustrates the suggested monitoring well construction/ design. Site-specific conditions may result in variations in well design and construction. The upper portion of the borehole must be sealed to prevent infiltration from the surface. Wells must be fitted with a lockable, above-ground protective device and clearly labeled. Flush-mounted wells should be constructed only when necessary. Monitoring well screens must be factory-fabricated. The screens must be long enough to accommodate seasonal groundwater level fluctuations. At a minimum, well screens must extend five feet above and below the static water level. Well construction details must be illustrated on the Soil Boring Log / Monitoring Well Construction Diagram (IDNR Form 542-1392). Assure well construction features are labeled and that the illustration accurately represents all dimensions.

Suggested Monitoring Well Construction Design

See Figure 1 on Tier 1 Assessment web page.

Groundwater Sample Collection:. Water levels must be measured, and monitoring wells must be purged of stagnant water in the casing prior to collecting groundwater for sample analysis. Generally, removal of water to dryness or 3 to 10 times the well volume of water is considered sufficient to obtain a groundwater sample representative of the surrounding formation. If the 3 to 10 well casing volumes cannot be removed, water quality parameters such as pH, temperature, or conductivity should be monitored to establish the water is representative of the formation from which it is taken. Purging must continue until water quality measurements have stabilized. Once the well has been sufficiently purged, groundwater should be allowed to recharge to the original measured static water level before sample collection. Groundwater sampling must be conducted in accordance with generally accepted industry standards. Refer to the following publications for additional guidance on well purging and groundwater sampling:

- American Society for Testing and Materials. 1996. *ASTM Standards on Groundwater and Vadose Zone Investigations: Drilling, Sampling, Well Installation and Abandonment Procedures.* ASTM Publication Code Number (PCN): 03-418196-38.

- American Petroleum Institute. 1989. *A Guide to the Assessment and Remediation of Underground Petroleum Releases.* API Publication 1628, 2nd edition. American Petroleum Institute.

- U.S. Environmental Protection Agency. 1993. *Subsurface Characterization and Monitoring Techniques: A Desk Reference Guide.* EPA/625/R-93/003a.

- U.S. Environmental Protection Agency. 1986. *RCRA Ground-Water Monitoring Technical Enforcement Guidance Document.* OSWER-9950.1.

Elevation Measurements: All elevations are to be reported as feet above sea level (ASL). Each must be referenced to a National Geodetic Datum permanent or monumented control point/benchmark. All ASL measurements taken at the site must be determined by a differential survey to the benchmark. Variations from this requirement must receive prior approval from IDNR. Ground surface elevations must be measured to the nearest 0.1 foot. Top of casing elevations and static water levels must be measured to the nearest 0.01 foot. An adequate number of water levels must be measured in each well to determine the static water level.

Groundwater Flow Direction: The groundwater flow direction must be determined from water level elevations taken from at least three wells in a triangular arrangement. If more than three wells have been installed on site, water level elevations from additional wells must also be used to determine flow direction. Monitoring wells and survey data from adjacent sites may be used, but is not required. However, all groundwater level measurements must be collected on the same date. An adequate number of water levels must be measured in each well to determine the static water level. Static water levels must be measured to the nearest 0.01 foot and ground surface elevations must be measured to the nearest 0.1 foot. All elevations must be reported as feet above sea level (ASL), and referenced to a National Geodetic Datum benchmark.

Protected Groundwater Source

A protected groundwater source is a saturated bed, formation or group of formations which has a hydraulic conductivity of at least 0.44 meters per day (m/d) ***and*** a total dissolved solids of less than 2,500 milligrams per liter (mg/l).

Total Dissolved Solids: If any of the hydraulic conductivity measurements exceed 0.44 meters per day, groundwater samples must be collected from the wells used to determine hydraulic conductivity, and analyzed for Total Dissolved Solids (TDS). The minimum TDS value is used to determine whether a protected groundwater source is present. If all hydraulic conductivity measurements are less than 0.44 meters per day, analysis for TDS is not required. If TDS is not determined, it will be assumed to be less than 2,500 mg/L.

Hydraulic Conductivity Measurements: Hydraulic conductivity is a measure of the capacity of a porous medium (rock or soil) to transmit water. It relates the specific discharge (volume per unit area) flowing through a porous material to the gradient (change in hydraulic head per unit distance). The department has determined that acceptable data for the computation of hydraulic conductivity (K) can be generated by performing small volume slug tests on near surface aquifers at LUST sites. This actual computation of K must be performed utilizing the Bouwer-Rice slug test data reduction method (Bouwer, H., 1989, The Bouwer and Rice Slug Test - An Update, Groundwater, Vol. 27, No. 3, pg. 304-309.) and must be reported in the units of **meters per day** (m/day). Hydraulic conductivity has a wide range of possible values (extremely large dynamic range) and each data reduction method used to determine the hydraulic conductivity requires some degree of interpretation. In an attempt to standardize the process of deriving K the department is offering the following comments and recommending the following procedures be considered.

1. If the site geology includes porous and permeable lithologies such as clean sands, gravels, and some alluvium types, large values of K may be expected. Special precautions should be taken during data acquisition to guarantee initial water level changes are adequately sampled. Where these lithologic types are present, manual measurement and recording of water levels during the slug test is not acceptable. The department recommends the use of an electronic data logger. The logger must be capable of measuring the water level at a minimum of every 0.25 seconds from the initiation of the test. The logger must also have adequate capacity to store the data for a period sufficiently long so the water level reaches 90% of its static value.

2. The Bouwer-Rice slug test data reduction method is not straightforward and requires interpretation of a complex (log) data plot. Each groundwater professional should become familiar with the physical principles underlying the method and the approximations associated with the interpretation of the data displays.

3. The department has experience using two software implementations of the Bouwer-Rice slug test data reduction method. They are:

    - AQTESOLV by Geraghty & Miller.
    - BRSLUG by LaDon Jones (Iowa State University)
    - While the department does not require use of a specific program, the results from any program used should be able to be replicated.. If a program other than AQTESOLV or BRSLUG is used, the groundwater professional must identify the program name, version, vendor name, address, and phone number.

4. Key well and aquifer parameters associated with the software-assisted computation of K must be carefully considered. The data set may include, but is not limited to, the radius of the well casing, radius of the test well, saturated thickness of the aquifer, vertical height of water in the test well, and length of screen through which water may enter the well. The effective casing radius, which is used to account for the thickness and porosity of the filter pack, must either be manually calculated or may, in some cases, be calculated by a computer program. If using AQTESOLV DOS Version 1.14, the calculation must be done manually and the effective radius value entered in lieu of the radius of casing value. BRSLUG Versions 1.0 and 1.1, AQTESOLV DOS Version 2.12 and Windows Version 1.17 will automatically complete the calculation based on a porosity value entered by the user. A default value of 15% must be used for gravel pack porosity. An alternative value which is greater than 15% may be used if a justification is provided. The user also enters the time (t) versus draw down (y) data and assigns a weight value to each entry. A weight value of zero (0) should be assigned to all recovery values after 90% of the initial draw down has been reached.

5. The department will accept non-software assisted reduction of slug test data. However, the probability of an arithmetic error is very high. Should a groundwater professional choose this manual technique, then:

    - All intermediate computations must be included in an organized, well documented and neat fashion.
    - Carefully plotted data display on semi-log printed graph paper is required.

6. The interpretation portion of the Bouwer-Rice slug test data reduction method should be approached with caution. If a "double straight line effect" is observed (see The Bouwer and Rice Slug Test - An Update), the best fit line should be adjusted to exclude the initial data points which may be attributed to drainage of the filter pack. The adjusted line must also exclude the data which deviates from the straight line as time increases, i.e., recovery greater than 90% of initial draw down.

7. Slug tests must be conducted in at least three (3) wells which, based on the stratigraphy of the site, can be expected to yield the largest value of hydraulic conductivity. Slug-out tests must be conducted on partially penetrating wells. In the event partially penetrating wells cannot be installed, slug-in tests must be conducted. The adjustment for the porosity of the filter pack in this case should not be conducted. Only the largest of the K values computed for a site is used for the Tier 1 pathway evaluation. Averaging calculated hydraulic conductivity values is not acceptable.

If groundwater and bedrock are not encountered during the course of the Tier 1 investigation, hydraulic conductivity testing is not required and the groundwater will **not** be considered protected. If bedrock is encountered above groundwater at any time, the groundwater will be considered protected regardless of hydraulic conductivity testing.

The following variables used in hydraulic conductivity calculations must be provided:

1. Well number.
2. Well depth.
3. Initial static water level
4. Volume of slug removed (or volume of slug added, if slug-in test)
5. Saturated thickness of the aquifer being tested (i.e., vertical distance from the static water table to an impermeable layer) (designated "H" or "D").
6. Length of screened portion through which water enters during slug test recovery (designated "L_e").
7. Vertical distance from the static water table to the bottom of the well (designated "L_w"). For a properly screened well, where the static water level is within the screened region, "L_w" and "L_e" are equal.
8. Radius of the well casing (designated "r_c").
9. Radius of the well (radius of casing plus thickness of the gravel pack) (designated "r_w").
10. Effective radius (calculated based on the thickness and porosity of the gravel pack) (designated "r_e").
11. Initial drawdown in the well (designated "y_o"; minimum initial drawdown should exceed 1.0 feet).
12. Recovery data [time (t) versus drawdown data (y_t); drawdown is calculated as distance between observed water level and initial static water level]

Hydraulic Conductivity Well Geometry Parameters - Partially Penetrating Well

See Figure 2 of the Tier 2 Assessment web page

Soil Gas Sampling (Optional)

Soil gas sampling may be conducted, but is not required, if the concentrations of chemicals of concern in the soil exceed the Tier 1 levels for the soil to enclosed space pathway. Soil gas must be sampled at the location of maximum soil concentrations, and at a depth above the water table expected to exhibit the highest gas reading based on field screening and analytical results. In order to verify the soil gas measurement is representative of the maximum expected gas level, two gas samples must be taken at least two weeks apart, with one of the samples taken during a seasonal period of lowest groundwater elevation and, if applicable, below the frost line. The following exploratory methods may be used to obtain soil vapor samples:

Option 1: A hollow, small-diameter (minimum 0.5-inch outside diameter), threaded steel casing fitted with a loose-fitting end plug is driven to the appropriate sampling depth. The casing is retracted a minimum of 12 inches to expose the soils in the sidewalls. The end plug should fit such that it remains in place at the bottom of the hole when the casing is retracted. The top of the casing is capped. Allow the soil air to stabilize for at least one hour prior to sampling. When direct-push technologies are used as a means of obtaining soil vapor samples, analysis using portable equipment is not acceptable. Samples must be collected using specialized sampler tubes and sent to a laboratory for analysis.

Option 2: A small-diameter (suggested 3-inch) hand auger boring is extended to appropriate sampling depth. A hollow, 1-inch diameter, threaded PVC casing perforated in the lower 12 inches is placed in the borehole. Sand backfill is placed to a depth not to exceed 18 inches above the bottom of the boring, covering the perforated section of the casing. The remainder of the borehole must be filled with hydrated bentonite to seal around the casing. The top of the casing is capped. Allow the soil air to stabilize for at least one hour prior to sampling.

Soil gas samples must be collected and analyzed using NIOSH Method 1501, or a department-approved equivalent. Soil gas is collected by means of adsorption onto solid activated carbon media. Glass tube samplers which comply with NIOSH Method 1501 and piston-type vacuum samplers are available commercially. The vacuum sampler used must be capable of drawing two hundred milliliters (200 ml) of casing air through the carbon media by either single or incremental operation. The pump must be factory calibrated according to manufacturer's specifications, and fitted with an indicator which visibly shows when the sampling cycle has been completed. Flow rates must be verified and volume checks must be conducted immediately prior to and immediately after sampling. Sampling equipment must be cleaned prior to each sampling event and stored to prevent cross-contamination. Cleaning of equipment must occur away from the sampling location and sufficient time must be allowed for the evaporation of any cleaning solvents which may interfere with chemical analysis.

Consult NIOSH Method 1501 and the instructions provided by the manufacturer of the sampler device for specific sampling procedures. The following general procedures are recommended to obtain a representative soil gas sample:

1. Attach a sufficient length of rubber tubing to the sampling pump to form an air tight seal.
2. Break the tip of the sampler tube and fasten the tube securely to the free end of rubber tubing with the arrow of the sampler tube pointing toward the pump.
3. Insert the sampler tube into the casing and position it so the inlet of the sampler tube is above, but within 6 inches of, the bottom of the casing.
4. Draw a 200 ml volume of soil air through the sampler tube and immediately withdraw it from the borehole casing.
5. Disconnect the sampler tube from the rubber tubing and seal the tube using the plastic caps provided by the vendor.

Standard handling and transporting procedures are used for the sampler tubes including the processing of chain-of-custody forms. Samples must be analyzed for benzene and toluene in accordance with NIOSH Method 1501. Analysis of sample blanks for quality assurance is recommended.

RECEPTOR SURVEY

Groundwater Wells: Active, abandoned and plugged groundwater wells within 1,000 feet of the source must be identified. Groundwater professionals must differentiate between wells which are drinking water wells and wells which are non-drinking water wells. A drinking water well is any groundwater well used as a source for drinking water by humans and any groundwater well used primarily for the final production of food or medicine for human consumption in facilities routinely characterized with the Standard Industrial Codes (SIC) group 283 for drugs and group 20 for food and kindred products. The Research and Information Services Division of Iowa Workforce Development may be contacted at 515/281-8178 (within the Des Moines area) or 1-800-532-1249 (within Iowa) to verify an SIC code for a facility. A non-drinking water well is any groundwater well not defined as a drinking water well including a groundwater well which is not properly plugged in accordance with department rules in 567--Chapters 39 and 49. One exception is an extraction well used as part of a remediation system. Extraction wells and monitoring wells are neither drinking water wells nor non-drinking water wells, and are not considered in the pathway evaluation.

Well information readily available from public entities (i.e., county health or zoning departments, IDNR Water Supply Section (515/242-6128), Geological Survey Bureau (GSB) (319/335-1575), etc.) and water well owners must be reported. Copies of IDNR form 542-1226 for wells plugged in accordance with 567--Chapter 39 must be provided. Copies may be obtained from the county assessor's office or the IDNR Water Supply Section. An on-site survey must be conducted to identify all the wells in a 300-foot radius of the source. All land owners within the 300-foot radius must be contacted.

Enclosed Spaces and Conduits: Buildings, enclosed spaces (basements, crawl spaces, utility vaults, etc.), and conduits (gravity drain lines, sanitary and storm sewer mains and service lines, plastic water lines and other utilities) within 500 feet of the source must be identified. Plastic drinking water lines (***mains and service lines***) within 200 feet of the source must be identified and evaluated according to Subrules 135.9(8) and 135.9(9). A description of the following must be provided for each conduit and enclosed space: construction material, conduit backfill material, slope of conduit and trench (include flow direction for sewers), burial depth of utility or confined space, and relationship to groundwater levels.

An explosive vapor survey is required in areas where the buildup of explosive vapor levels could occur such as, but not limited to, basements, crawl spaces and utility access ways. The purpose of the explosive vapor survey is to identify conditions immediately hazardous. If explosive vapor levels are identified (concentrations of combustible gases exceeding 10% of the Lower Explosive Limit [LEL]), the groundwater professional must notify the tank owner or operator or a party reasonably believed to be responsible for reporting the contamination with instructions to report the condition in accordance with 567--Chapter 131. The owner or operator must begin immediate response and abatement procedures in accordance with 135.7 and 567--Chapter 133. The situation will be handled under IDNR's Emergency Response protocols.

An explosive vapor survey may not be necessary in all cases; however, adequate justification for not conducting the survey must be provided (e.g., buildings, confined spaces or utility access ways are not located within 500 feet, Tier 1 levels for the pathway are not exceeded, etc.).

An explosive vapor survey must be conducted at sites where reports of vapors have been received, or there are indications that contamination is or is likely to be in contact with occupied structures or utilities. Records filed with the Emergency Response Section and the Underground Storage Tank Section of the IDNR, State Fire Marshall's Office, County Health Department, and the local police and fire department should be examined to determine whether any vapor problems have been reported in the area.

Explosive Vapor Survey. The following procedures are recommended when conducting an explosive vapor survey:

1. An explosimeter must be used to take vapor readings.
2. Start at the utility access way nearest to the site. Work upstream and downstream to determine whether vapors are present, where vapors may be entering, and the extent of impacted area.
3. "Crack" each utility access cover and take readings for oxygen and percentage explosion level. Repeat measurements at mid-depth and water level or bottom of conduit.
4. Check air flow directions to determine if dilution of vapors is occurring.
5. Check lift stations near the site.
6. Check confined spaces and occupied structures. Record the names and addresses of buildings, residences and owners.
7. Check for vapors in basements, sewer drains, and near any foundation cracks.

Surface Water Bodies: Surface water bodies include both general use segments and designated use segments as defined in 567--61.3(1) of the IAC. All surface water bodies (i.e., lakes, ponds, rivers, streams, intermittent stream beds, drainage ditches, etc.) within 200 feet of the source must be identified and visually inspected for a sheen on the water surface, and residues along a stream bank or bed. The following procedures are recommended when conducting a visual inspection for petroleum residue along a stream bank or in an intermittent stream bed:

Stream bank:

1. Look for bare soil areas along the lower bank where the seep of petroleum products may be surfacing and killing vegetation.
2. During the growing season, look for dead or dying vegetation along or below the high-water mark. Inspect the dead vegetation to determine whether death was caused naturally or by coating with petroleum residues. The residues usually will cause localized portions of the plant to be stressed or to die. A coating of slightly shiny, brown/black dirt-type particles (the mixture of petroleum products and the suspended/floating material found in the stream) may occur on the vegetation. The dead or dying vegetation will likely be in small patches or clumps, not large expanses as would occur if the vegetation were dying from being inundated for a long time.

Stream bed:

1. Similar to the vegetation coating but potentially more evident; a shiny-spongy brown/black dirt-type coating may occur on the material found along a previous water line.
2. Also look in the areas that become isolated pools when the stream no longer flows. The petroleum residue will tend to accumulate in these isolated pools, coating the stream bed material including branches, rocks and debris.

If a sheen or residue is evident or has been reported to be present, the groundwater professional must make a sufficient investigation to reasonably determine its source. If, in the opinion of the groundwater professional, the sheen is not associated with the underground storage tank site, an adequate justification must be provided. If, in the opinion of the groundwater professional, the sheen is not a petroleum-regulated substance, a sample must be laboratory analyzed using Iowa Methods OA-1 and OA-2 and in accordance with 135.16 to confirm it is not a petroleum-regulated substance.

TIER 1 CORRECTIVE ACTION RESPONSE

No Action Required Site Classification. At the completion of Tier 1, the site will either be classified no action required or a Tier 2 SCR will be required. Every pathway must meet the requirements for no further action clearance as specified in the "Tier 1 Pathway Evaluation" section of this guidance document for the site to be classified as no action required. If the department determines that a no action required site classification is appropriate, a no further action certificate will be issued as provided in Subrule 135.12(10). In the situation where some pathways meet the requirements for no further action clearance but other pathways do not, only those pathways which do not meet the no further action clearance requirements must be evaluated as part of a Tier 2 SCR.

Compliance Monitoring and Confirmational Sampling. Compliance monitoring is not an acceptable corrective action at Tier 1. Except as part of the soil gas sampling procedures, confirmation sampling to verify that a sample does not exceed any Tier 1 levels is not required. However, the department retains the authority to require confirmation sampling from existing groundwater monitoring wells if 1) a no action required classification is being proposed at Tier 1; and 2) the department has a reasonable basis to question the validity of the samples based on, for example, the seasonal bias of the sampling, evidence of multiple sources of releases, marginal groundwater monitoring well locations, static water level above the screened interval, and analytical variability.

Institutional Controls: The purpose of an institutional control is to restrict access to or use of property such that an applicable receptor could not be exposed to chemicals of concern at any applicable points of exposure for as long as a Tier 1 level is exceeded. For example, if the Tier 1 level for potential receptors is exceeded and a protected groundwater source exists, an institutional control could be established which prohibits the installation of wells within 1,000 feet of the site. With this type of property use restriction, the pathway could be considered severed and no further action regarding the pathway would be required.

Institutional controls include any of the following:

1. A law of the United States or the state;
2. A regulation issued pursuant to federal or state laws;
3. An ordinance or regulation of a political subdivision where real estate subject to the institutional control is located;
4. A restriction on the use of or activities occurring at real estate which are embodied in a covenant running with the land which:
    - Contains a legal description of the real estate in a manner which satisfies Iowa Code section 558.1 et seq.,
    - Is properly executed, in a manner which satisfies Iowa Code section 558.1 et seq.,
    - Is recorded in the appropriate office of the county where the real estate is located,
    - Adequately and accurately describes the institutional control; and
    - Is in the form of a covenant as set out in Appendix E or in such a manner reasonably acceptable to the department;
5. Any other institutional control the owner or operator can reasonably demonstrate to the department will reduce the risk from a release throughout the period necessary to assure no applicable target level is likely to be exceeded.

If an institutional control is to be used to obtain pathway clearance at Tier 1, complete documentation of the institutional control (copies of ordinances, deed restrictions, etc.) must be provided before the department will approve pathway clearance or a no action required site classification. It must be apparent in the documentation that the institutional control will cover the entire affected area (e.g., prohibit well installation within a 1,000-foot radius of the source, prohibit the placement of subsurface enclosed spaces within a 500-foot radius of the source). Documentation may be provided as an appendix to the Tier 1 report, or if a Tier 2 assessment is required for any other pathway, documentation may be provided as an appendix to the Tier 2 SCR.

Modification or Termination of Institutional Controls. If the department determines an institutional control has been removed or is no longer effective for the purpose intended, regardless of the issuance of a no further action certificate or previous site classification, it may require owners or operators to re-evaluate the site conditions as necessary to determine an appropriate site classification and corrective action response. If the owner or operator is in control of the affected property, the department may require re-implementation of the institutional control or may require a Tier 2 SCR be completed for the affected pathway(s) to re-evaluate the site conditions and determine an alternative corrective action response. An owner or operator subject to an institutional control may request modification or termination of the control by completing a Tier 2 SCR for the affected pathways or conduct such other assessment as required by the department to establish the control is no longer required, given current site conditions.

If the owner or operator is not in control of the affected property or cannot obtain control and the party in control refuses implementation of an institutional control, or to continue an institutional control, the department may require the owner or operator to take such legal action as available to enforce institution of the control or may require the owner or operator to complete a Tier 2 SCR to determine site classification and an alternative corrective action response. If a person in control of the affected property appears to be contractually obligated to maintain an institutional control, the department may, but is not required to, attempt enforcement of the contractual obligation as an alternative to requiring corrective action by the owner or operator.

If a site is classified no action required subject to the existence of an institutional control, the holder of the fee interest in the real estate subject to the institutional control may request, at any time, that the department terminate the institutional control requirement. The department shall terminate the requirement for an institutional control if the holder demonstrates, by completion of a Tier 2 SCR for the affected pathway(s) or other assessment as required by the department, that the site conditions warranting the control no longer exist (i.e., that no applicable target risk will be exceeded if the institutional control is terminated).

Replacement / Relocation of Plastic Water Lines. Replacing or relocating plastic water lines currently located within 200 feet of soil or groundwater contamination which exceeds the applicable Tier 1 levels are acceptable corrective actions for the groundwater to plastic water line pathway and soil to plastic water line pathway. Prior to replacing or relocating plastic water lines, the utility company which supplies water service to the area must be contacted and give approval for such activities. If the plastic water lines are to be replaced, a non-plastic material must be used (copper, cast iron, etc.). If the plastic water lines are to be relocated, they must be placed beyond 200 feet of the contamination source(s). An adequate investigation of the relocation area must be conducted to assure the lines are not placed into contaminated soil or groundwater. A file search and pedestrian survey are recommended to determine whether there are other UST or LUST sites in the area of pipe relocation.

A report of the water line replacement / relocation activities must be provided as an appendix to the Tier 1 report. The report must include the following:

1. Documentation of authorization from the utility company which supplies water service to the area.
2. If the plastic water lines were replaced, identification of the replacement material, backfill material, and burial depth of reconstructed water line(s).
3. If the plastic water lines were relocated, identification of the backfill and burial depth of the relocated lines, and a brief description of the efforts taken to assure the new location was not contaminated.
4. A scaled site diagram with the following illustrated:
   - pertinent site features such as buildings, roads, utilities, etc.,
   - soil and groundwater contamination in relation to the plastic water line(s) prior to replacement / relocation,
   - if the plastic water lines were relocated, the location of the new lines (an additional map with appropriate scale to show the new location of the lines may be necessary)

Soil Excavation. Excavation for the purpose of removing contaminated soil which exceeds the Tier 1 levels in the Tier 1 table is permissible for the soil leaching to groundwater pathway, soil vapor to enclosed space pathway, and soil to plastic water line pathway. Prior to excavation, field screening must be conducted to estimate the extent of soil contamination.

The excavation must remove the area of soil with concentrations above the Tier 1 levels for the affected pathway. If excavation is conducted, additional soil sampling is necessary to demonstrate that after excavation the remaining soil concentrations do not exceed the Tier 1 levels for the affected pathway. At a minimum, one soil sample must be collected for **field screening** every 100 square feet of the base and sidewalls of the excavated area. Field screening shall include the use of a photoionization detector (PID), flame ionization detector (FID), or another similar vapor analyzer, and visual and olfactory observations. Observations and vapor screening results must be documented. Soil samples must be collected for **laboratory analysis** from points indicated by high vapor readings (greater than 10 ppm), or observed contamination, and at least one soil sample collected for every 400 square feet of the base and sidewalls of the excavated area. At a minimum, one sample from each sidewall and the base of the excavation must be collected and analyzed. Samples for laboratory analysis shall be collected from not more than one foot into the base and sidewalls of the excavated area.

All samples shall be shipped to a certified laboratory within 72 hours of collection. Samples shall be refrigerated and protected from freezing during shipment to the laboratory. The soil samples must be analyzed for benzene, toluene, ethylbenzene, and TEH in accordance with 135.16.

Excavated contaminated soils must be properly disposed in accordance with 567--Chapters 100, 101, 102, 120, and 121. If land application of petroleum contaminated soils is used as a means of treatment, a notification for land farming (DNR Form 542-1384) must be submitted to the department prior to land applying the contaminated soil. This form may be obtained by calling 515/242-6492.

A report of the excavation must be provided as an appendix to the Tier 1 report. The report must include the following:

1. Results of field screening.
2. Copies of the analytical data obtained from the soil samples.
3. A scaled site diagram with the following illustrated:
   - area of the original contamination,
   - dimensions and limits of the excavation,
   - field screening sampling locations,
   - location of soil samples submitted for laboratory analysis,
   - groundwater sampling borehole and well locations,
   - pertinent site features such as buildings, roads, utilities, etc.,
   - groundwater flow direction.

Expedited Corrective Action. An owner or operator of a site where a release of a petroleum-regulated substance is suspected to have occurred may conduct corrective actions under the following conditions:

1. The department receives notice of the expedited cleanup activities within 30 calendar days of their commencement.
2. The owner or operator complies with the provisions of Subrule 135.12(11).
3. The corrective action does not include active treatment of the groundwater other than as previously approved by the department, or free product recovery pursuant to Subrule 135.7(4).

Expedited corrective action is not intended to be a substitute for a site check or tiered evaluation. The purpose is to provide a mechanism for limited and prompt remediation without unnecessary delays for proposal submittal, department review, etc. Generally, expedited corrective action is limited to excavation of contaminated soils. Excavation activities must be conducted in accordance with procedures in Subrule 135.12(11) and the soil excavation requirements identified in this guidance. Excavation may be conducted at any time including in conjunction with a Tier 1 or Tier 2 site assessment. However, adequate sampling must be conducted to determine the levels of contaminants in soil before and after the excavation. Groundwater sampling shall be required as provided in either 135.6(3)b, site check procedures or 135.9(1), Tier 1 site assessment procedures. A report of the excavation which includes the information listed in the previous subsection must be submitted as part of a site check report or as an Appendix to the Tier 1 or Tier 2 report, whichever applies.

REQUIREMENTS FOR REPORT MAPS AND APPENDICES

Attach the following appendices to the end of the Tier 1 report form in the order listed. Title each appendix consistent with the bold print below.

1. **Topographic Site Map.** Provide a topographic map of the site and surrounding area developed from work done at the site, city surveys where available or USGS maps. Legible contour elevation differentials no greater than twenty feet must be provided. If a local survey, city survey or USGS map is used, identify the map scale and date of map.

2. **Site Plan.** Provide a scaled map (scale 1 inch = 20 to 50 feet) of the site and the immediate surrounding area. It must show, but is not limited to the following:
   1) Location and content of existing and removed USTs, product lines and dispensers.
   2) Pertinent site features (i.e., property boundaries, buildings, roads, wells, waterways, sinkholes, etc.). Label street names.
   3) Location of subsurface utilities.

3. **Site Vicinity Map** Provide a scaled (scale 1 inch = 200 to 500 feet) vicinity map showing the site in relation to surrounding general features. It must show, but is not limited to the following pertinent general features: roads, waterways, sinkholes, property boundaries, and existing structures such as schools, hospitals, child care facilities and other buildings. It must also show which areas are zoned for residential use.

4. **Field Screening Map.** Provide a site map which depicts the field screening sample locations in relation to the existing or former tank system, and other areas of suspected releases. Identify tank basins, piping, dispensers, buildings and utilities on site and label roads bordering the site. Label each field screening sample point with the highest vapor reading for that boring and indicate the depth at which the highest vapor reading was found (e.g., 310 ppm - 15' bgs). Identify in the map legend the type of vapor screening device used (PID, FID, etc.).

5. **Soil Contamination Maps.** Provide soil contamination maps which depict the sample locations and soil analytical results used for the Tier 1 site analysis, including data obtained from the Tier 1 field assessment, tank closures, site checks, or other investigations of the release at the site. A separate map for each chemical of concern is not necessary if each can be clearly labeled on one map. If soil gas samples were collected, label the soil gas sample locations and indicate the soil gas analytical results.

6. **Groundwater Contamination Maps.** Provide groundwater contamination maps which depict the sample locations and analytical results used for the Tier 1 site analysis, including data obtained from the Tier 1 field assessment and other investigations of the release at the site. A separate map for each chemical of concern is not necessary if each can be clearly labeled on one map.

7. **Groundwater Flow Direction Map.** Provide a groundwater flow map based on work done at the site and the adjacent area. Identify the following on the map: all wells installed on site, groundwater elevations measured for each well, groundwater flow direction (with an arrow), the wells used to determine hydraulic conductivity, and the date groundwater elevations were measured. If a sufficient amount of data has been collected, groundwater contours, labeled with the contour elevations, may be added to the map. Wells constructed in different aquifers must be identified.

8. **Well Survey Map.** Provide a site area map which identifies all groundwater wells including drinking water wells and non-drinking water wells within 1,000 feet of the source. Ensure the map is appropriately scaled.

9. **Enclosed Space and Conduit Map.** Provide a site area map which identifies all buildings, confined spaces, and conduits within 500 feet of the source. Highlight the location of all plastic water lines within 200 feet of the source. Identify the enclosed space vapor sampling locations on the map. If the enclosed space is a residential property, provide a copy of the access agreement or identify the owner / tenant of the property and date of the survey. Number all enclosed spaces and conduits on the map to coordinate with "conduit number" from the Enclosed Space / Conduit Survey Table in the Tier 1 report form.

10. **Surface Water Map.** Provide a site map which identifies all surface water bodies within 200 feet of the source. Ensure the map is appropriately scaled.

11. **Tank and Line Tightness Test Results.** If active tanks are present on site, attach copies of the latest tank system tightness test results and supporting field data and provide a description of the leak detection method and a summary of results for the most recent quarter. Although, a summary is preferable, copies of leak detection results for the most recent quarter may also be submitted as supporting documentation of the integrity of the tank system.

12. **Laboratory Data Sheets.** Provide copies of all laboratory data sheets including those for Total Dissolved Solids analyses, if applicable. Provide copies of all Chain of Custody forms. Submit chromatograms and associated quantitation reports for the waste oil, diesel, and gasoline standards used by the laboratory to identify and quantify the field samples. The laboratory analytical report must state whether the sample tested matches the laboratory standard for waste oil, diesel or gasoline or that the sample cannot be reliably matched with any of these standards. Submit chromatograms for those soil and groundwater samples with the maximum concentrations of BTEX and TEH. Chromatograms for all other sample analyses should be obtained from the laboratory and made available to the department upon request.

13. **Soil Boring Logs.** Complete and attach DNR Form 542-1392 for each soil boring/monitoring well placed to investigate the petroleum release at this site, including boring logs and well construction diagrams for the Tier 1 assessment and any historic investigations. Indicate the casing and screen material and screen slot size on each diagram. Include the static water level symbol "v" on the diagram for the water level at the time of sampling. At least one static water level measurement must be taken and indicated at the bottom of the log for each boring and well installed at the site. Each log must include vapor screening results and the soil sample(s) which was sent for laboratory analysis indicated.

14. **Hydraulic Conductivity Measurements.** Provide a copy of the plots of the time versus drawdown data and field data collected to determine the hydraulic conductivity. Indicate the units (meters, feet, seconds, etc.) for each field variable. Provide a copy of any calculations done by hand. Complete a Hydraulic Conductivity Well Diagram for each well which was tested and attach with this appendix.

15. **Well Logs.** Provide copies of all available well logs for drinking water wells and non-drinking water wells and copies of DNR Form 542-1226 for wells plugged according to 567--Chapter 39.

16. **Pathway Evaluation Worksheet.** Complete and attach the Tier 1 Pathway Evaluation Worksheet only if the Tier 1 software is *not* used to evaluate the site. A blank copy of this worksheet can be found in Appendix C of this guidance. For each pathway, follow the sequence of questions to determine whether the pathway passes (clears) the Tier 1 evaluation. Begin by answering the first general question. Circle your response to each applicable question (Y for "yes" or N for "no"). Your response will dictate which question should be answered next. Upon completion of the questions, complete the pathway evaluation summary on page 3 of the Tier 1 Report.